GFR by Iohexol

M.Med. discussion by Dieter van der Westhuizen

Thyroid Carcinoma

A case of Thyroid carcinoma

Hyperaldosteronism

HOSP #		**WARD**	Murraysburg Hospital, Female Ward
CONSULTANT		**DOB/AGE**	51 y female

Abnormal Result

Aldosterone: 1380 pmol/L

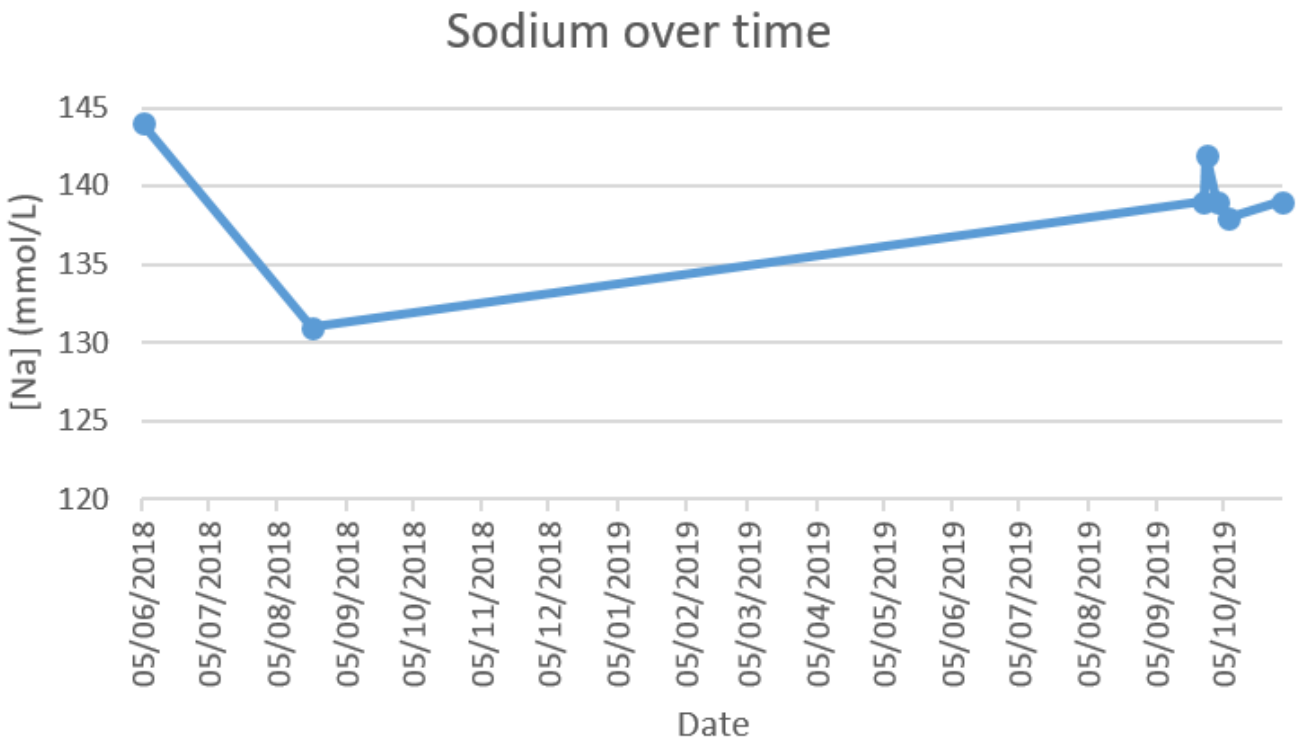
Renin: 2.1 ng/L

Aldosterone: Renin ratio: 657.14 pmol/ng

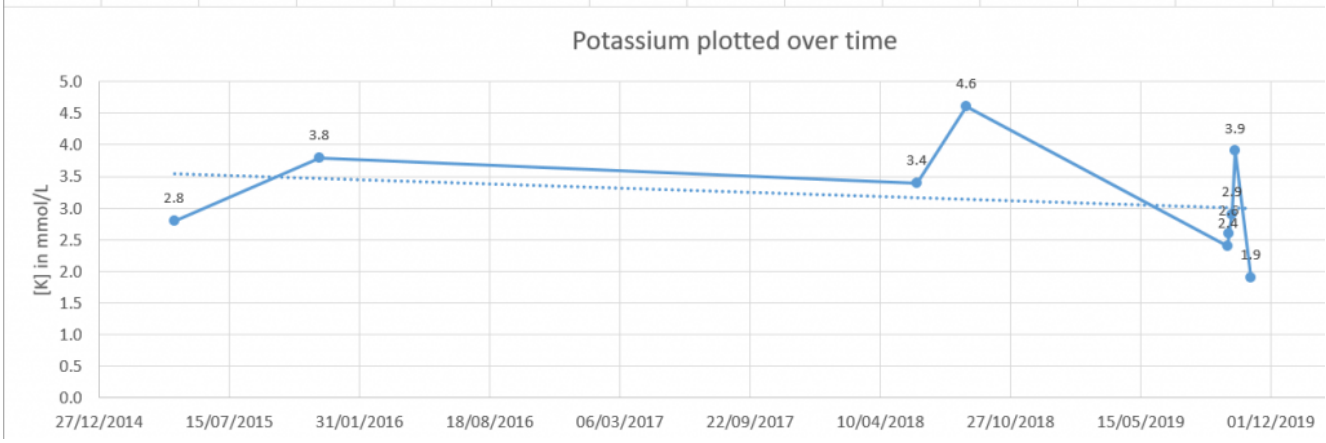
Presenting Complaint

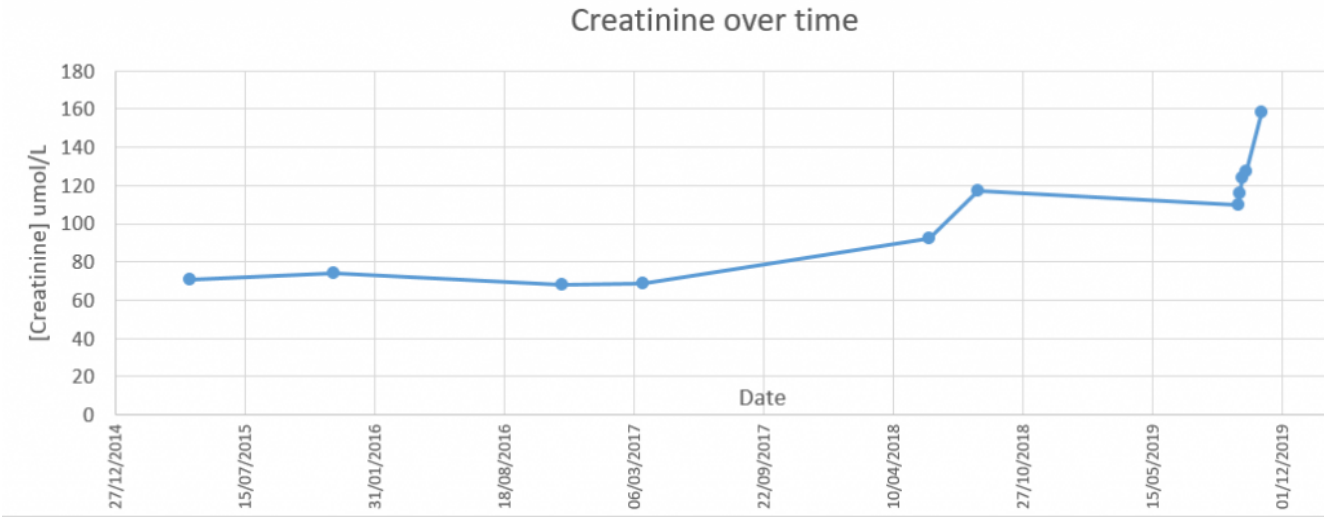
Uncontrolled Hypertension, unresolved on maximum dose of 3 antihypertensives.

History



	31/10/2019	07/10/2019	02/10/2019	27/09/2019	26/09/2019	20/08/2018	05/06/2018	30/11/2015	21/04/2015
K	**1.9**	**3.9**	2.9	2.6	2.4	4.6	3.4	3.8	2.8





Examination

Laboratory Investigations

Hos	Murraysburg Hospital wc MBH	☎ 049 844 0053	Received	07/10/2019	17:57	
Wrd	Female Ward	☎	Registered	07/10/2019	17:58	
Doc	DR HUMAN	☎			ePR	I Deta

Test Set	Staff Notes	Test Item	Result	Units	Normal Values	Previous Result 1
ALDOS	✓	Aldosterone	1,380.0	pmol/L		
		Patient condition				
		Aldosterone auto comm	ALDO4			
RENIN		Renin mIU		mIU/L		
		Renin ng	2.1	ng/L		
		Aldosterone : renin ratio	657.14	pmol/ng		

Other Investigations

Urine electrolytes

	01/10/2019 15:32
UNa	59
UK	27,5
Ucreat	4,1
Uprotein	0,27
Uprot:creat	0,066

Serum Results

Date	Sodium mmol/L	Potassium mmol/L	eGFR ml/min	GGT U/L	Chol mmol/L	TSH mIU/L	T4 pmol/L	FreeT3 pmol/L	Cort nmol/L
21/04/2015		2,8	>60		5,07				
30/11/2015		3,8	>60		4,53				
15/11/2016			>60		4,04				
20/03/2017			>60		4,36				
05/06/2018	144	3,4	56		4,39	1,79	11,9	5	394
20/08/2018	131	4,6	42						
21/08/2018									
24/08/2018									
26/08/2018									

26/08/2018									
26/09/2019	139	2,4	45			0.81			
27/09/2019	142	2,6	43						
01/10/2019									
02/10/2019	139	2,9	40			CEGK			
03/10/2019									
07/10/2019	138	3,9	38						
31/10/2019	139	1,9	30	28					

Urine metanephrines

Urine collection period	24 h	Reference value
Urine volume	3080 ml	
Ucreat	2,2 mmol/L	
Umetadren	160 nmol/L	
Unormetadren	870 nmol/L	
dUmetadren	493 nmol/24h	152-913
dUnormetadren	2680 nmol/24h	699-2643
Umetadren:cr	73 nmol/mmol creat	17-91
Unormetad:cr	395 nmol/mmol creat	75-309

Final Diagnosis

Primary hyperaldosteronism causing secondary hypertension with accompanying renal injury.

Take Home Messages

Reference Ranges for Aldosterone:

- Upright 70 – 1066 pmol/L
- Supine 49 – 643 pmol/L

Screening for primary hyperaldosteronism: most sensitive when

>350 pmol/L

Reference Ranges for Renin:

- Upright: 2.7 – 27.7 ng/L
- Supine: 1.7 – 23.9 ng/L

Beta-blockers suppress renin levels and should be stopped 2 weeks before testing.

Aldosterone: Renin Ratio:

Most sensitive when the ratio is **>118** pmol/ng.

Effects of hyperaldosteronism

- One's expectation is a high serum sodium, but since it normalizes with an increase in fluid volume, hence hypertension as in this case, there is normal sodium.
- Low serum potassium due to loss in urine, although this can also be normal.
- Increased urine potassium concentration (>30 mmol/L) in a random urine specimen suggests increased mineralocorticoid effect.
- The renin:aldosterone ratio is used to compensate for the increase in aldosterone which is caused by an increase in renin (for instance which is caused by hypovolemia or low blood pressure).
- Some studies recently published are suggesting that the prevalence of hyperaldosteronism are significantly more than was (and is) thought, and hence urinary (24 hour) aldosterone measurement may be more accurate to screen for hyperaldosteronism. The authors of recent estimates of the prevalence of hyperaldosteronism are of opinion that hyperaldosteronism may be the cause of around 10% of unexplained "essential" hypertensives (see attached articles).

Hyperaldo-prevalence-2020Download
Primary-hyperaldo-Editorial-2020Download

Drip line contamination – Ringers Lactate

A case of drip line contamination.

Albumin Assay – Bromocresol Green method

Practical assay for albumin measurement

Total Protein assay – Bradford

A practical experiment to illustrate the measurement of total protein in serum using the Bradford assay

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Hypernatremia

Case of a child with extreme hypernatremia.

Prolactin

HOSP #		WARD	ENT Clinic
CONSULTANT		DOB/AGE	35 Y Male

Abnormal Result

Prolactin 10 986.0 ug/L (4-15.2)

Dilutions:

1/10 >4700;

1/100 = 10821;

1/50 = 10 986.

Presenting Complaint

Epistaxis

History

Patient with epistaxis referred to the ENT specialist clinic. No relevant medication history.

Examination

35 y male with a large left post-nasal space mass, a vascular mass involving the pituitary fossa.

?NBL (non-benign lesion)

?Sinonasal malignancy

?Pituitary Tumour

Laboratory Investigations

TSH 0.91 pmol/L (0.27-4.20)

Free T4 15.7 pmol/L (12-22)

FSH 0.8 IU/L ↓ (1.5-12.4)

LH 0.2 IU/L ↓ (1.7-8.6)

Testosterone 0.2 nmol/L ↓ (8.6-29.0)

PTH 1.7 pmol/L (1.6-6.9)

Prolactin measuring method:

The Elecsys prolactin sandwich immunoassay uses two monoclonal antibodies directed against human prolactin.

R1 = biotinylated antibody – recognizes the N-terminal end of the
prolactin molecule

R2 – ruthenium complexed antibody probably reacts with a region in the
middle of the prolactin molecule.

1st incubation: a biotinylated monoclonal prolactin-specific antibody and a monoclonal prolactin-specific antibody labeled

with a ruthenium
complex form a sandwich complex.

2nd incubation: after addition of streptavidin-coated microparticles, the complex becomes bound to the solid phase via interaction of
biotin and streptavidin.

Reaction mixture aspirated into the measuring cell where microparticles
are magnetically captured into the surface of the electrode. Unbound substances are then removed with
ProCell.

Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier, results
calculated by a standard curve.

Other Investigations

Monomeric prolactin – 7744 ug/L (70% recovery after PEG precipitation)

Biopsy: confirmed tumour stained strongly positive
with prolactin suggesting a prolactinoma.

Final Diagnosis

Pituitary Macroprolactinoma

Take Home Messages

Sandwich immunoassays are prone to high dose hook-effect. There are
various ways to overcome this effect. (This will later be expanded on – see AFP

/ Beta-HCG).

Prolactin appears in the serum as:

1. Active monomeric prolactin (“little”) (80%) 23kDa
2. Inactive dimeric prolactin (“big”) (5-20%) 50-60kDa
3. Low activity tetrameric prolactin (“big-big”) (0.5-5%) 150-170kDa

Precipitation by PEG yields the active monomeric prolactin, expressed as a percentage recovery after precipitation. Big-big prolactin consists of an antigen-antibody complex of monomeric prolactin-immunoglobulin G and is defined as macroprolactin. This has a long half-life in blood when compared to normal prolactin and gives false high readings of prolactin, leading to unnecessary investigations in certain cases. A high prolactin should thus be confirmed by doing a PEG precipitation.

Fluid Triglycerides

A case of high fluid triglycerides

ACTH

HOSP #		WARD	G16 Medical Ward
CONSULTANT		DOB/AGE	54 y Female

Abnormal Result

21/08/2018 Two ACTH tests (referred to another laboratory) and two
Cortisol levels (at our laboratory) were done.
At first it was thought to be a dexamethasone suppression test, but then
realized the clinicians were suspecting hypopituitarism.

10h05: **ACTH 0.7 pmol/L ↓** (1.6-13.9) Cortisol 8 nmol/L ↓ (Morning: 133- 537; Afternoon 68 – 327)

10h35: ACTH 1.8 pmol/L N (1.6-13.9)
Cortisol 68 nmol/L ↓ (Morning: 133- 537; Afternoon 68 – 327)

Presenting Complaint

? hypopituitarism

History

Known with a pituitary macroadenoma, previously seen at the Radiotherapy clinic in 2016.

Examination

No clinical info available.

For Primary adrenal insufficiency one would expect: Hyperpigmentation
(due to ↑ ACTH), +/- hyperkalemia/hyponatremia (aldosterone

effect), +/-
virilization.

For Secondary adrenal insufficiency there is subtle symptoms, electrolytes are not deranged significantly because aldosterone function is preserved. See table on Bishop 7th ed. p. 459.

Laboratory Investigations

Measurement of
plasma ACTH concentration is used to assess Cushing's disease, adrenal tumors,
ectopic ACTH-producing tumors, Addison's disease, Nelson's syndrome, and
hypopituitarism.

The
laboratory diagnosis of hypopituitarism, however is relatively straightforward.
In contrast to the primary failure of an endocrine gland that is accompanied by
dramatic increases in circulating levels of the corresponding pituitary tropic
hormone, secondary failure (hypopituitarism) is associated with low or normal
levels of tropic hormone. This is the
diagnosis in this case with the history of previous radiotherapy which was
given for a macro-adenoma.

Other Investigations

Free T4 on 19/04/2018 was 7.8 pmol/L (12-22), also suggesting possible hypopituitarism, although a TSH would be helpful.

Final Diagnosis

Hypopituitarism confirmed.

Take Home Messages

Dexamethasone suppression test need only measurement of cortisol, not accompanying ACTH, except in extended work-up however, where a Cosyntropin (CRH) stimulation test can be done to distinguish between pituitary or hypothalamic insufficiency.

Evaluation of pituitary function need the Primary hormone (Cortisol) as well as the tropic hormones from the pituitary (ACTH).

Paracetamol Overdose

HOSP #		**WARD**	C15 Casualties
Consultant		**DOB/AGE**	33 year Female

Abnormal result

Paracetamol 25ug/ml (163 umol/L) Serum osmolarity 310mmol/L

Presenting Complaints

Brought to casualties with stupor from Mitchells Plein Hospital.

History

33 y female presented with stupor after ingestion of an unknown amount of pills. Empty container of Amitriptiline and Paracetamol was found with her.

Examination

Non-specific neurologic signs, but delirium present. Patient did have an episode of vomiting. No pathological signs on abdominal examination.

Laboratory Investigations

12/08/2018: Na 156 mmol/L (H) Urea 4.2mmol/L
Tot. Bili 4 umol/L K 1.9 mmol/L (L) Creat 88 umol/L ALT 82 U/L Cl 97.9 mmol/L (L) Gluc 3.52 mmol/L AST 238 U/L Ammonia 35 umol/L
Bicarb 16.6 mmol/L (L) Osmol 310 mmol/L (H) Osmolar gap: -10 mM Anion Gap: 47 mmol/L

Marked elevation of hepatocellular enzymes, ductal enzymes within normal range. Within the course of three days the patient developed Klebsiella Pneumoniae on intubation in ICU with DIC and marked renal failure (Creat 506, Urea 26.8) and demised in ICU 3 days after admission, although liver enzymes were not markedly more deranged as initial presentation.

Paracetamol: The Paracetamol level was never repeated after admission. Doing an in-house experiment with calibrator and spiking the calibrator samples with N-acetylcysteine correlating with therapeutic plasma levels, I demonstrated that our method on the Roche analyzer, with the enzymatic assay, causes a clinically significant negative interference in the measured paracetamol.

The enzymatic assay principle:

arylacylamidase hydrolysis o-cresal + periodate catalyst

Acetaminophen→ p-aminophenol+acetate → indophenol (measured @600nm)

Other Investigations

Tricyclic antidepressant levels 58 ug/L ([TCA] in overdose patients range from 29-1732ug/L, but has not been found to correlate to clinical outcome, unless plasma level is more than 1000ug/L).

Final Diagnosis

Klebsiella Sepsis (confirmed on blood culture 1 day after death) DIC with marked renal failure.

Take Home Messages

- Paracetamol reporting units must be confirmed, we generally use ug/ml, but it has created confusion previously, as nomograms used in South Africa generally use ug/ml.
- N-acetyl cysteine may cause negative interference with the measurement of paracetamol in the enzymatic assay. Sampling for Paracetamol levels should thus be done before an IV dose of NAC is given to eliminate this possible error. National guidelines with toxicology will likely be amended.